SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, Takehiro Ikeda, a citizen of Japan residing at 330-11, Kujira, Gose-shi, Nara 639-2312 Japan, Ichiro Okajima, a citizen of Japan residing at 968-12-1-302, Mutsuura-cho, Kanazawa-ku, Yokohama-shi, Kanagawa 236-0032 Japan and Takuya Shinozaki, a citizen of Japan residing at 15-11-101, Kamariyahigashi 6-chome, Kanazawa-ku, Yokohama-shi, Kanagawa 236-0042 Japan have invented certain new and useful improvements in

METHOD FOR PROVIDING INFORMATION, MOBILE COMMUNICATION SYSTEM, AND COMMUNICATION APPARATUS

Of which the following is a specification:-

TITLE OF THE INVENTION

METHOD FOR PROVIDING INFORMATION, MOBILE COMMUNICATION SYSTEM, AND COMMUNICATION APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method for providing information in a mobile communication system including a router connected to a predetermined network, and a plurality of communication apparatuses which can communicate with mobile terminals and are connected to the router, wherein information on the predetermined network is provided to the mobile terminals. The present invention also relates to the mobile communication system and the communication apparatuses, wherein both the system and the apparatuses employ the method for providing information.

2. Description of the Related Art

Information service which provides, for example, information on the Internet to the mobile terminals has become common recently. In such information services, the information on the Internet is transmitted to the mobile terminal via a router connected to the Internet and also via any one of the plurality of communication apparatuses (access points) connected to the router.

When an access point receives a location registration request from a mobile terminal located in a service area provided by the access point, the access point transfers information relating to the mobile terminal (mobile terminal information) to a router. The router updates a routing table held and used for managing communication paths to the mobile terminals, using the mobile terminal information from the access point. Then, when the destination of the information on the Internet is a mobile

terminal, the router transfers it only to the access point providing the service area where the destination mobile terminal is located, on the basis of its routing table.

However, according to the conventional method for providing information described above, since there is a time lag between when the mobile terminal transmits the location registration request to the access point providing the service area where the mobile terminal is located and when the router updates its routing table, errors may occur in the communication paths via which the information on the Internet is transferred.

It is specifically considered that, before the router updates its routing table, a mobile terminal moves from one service area provided by one access point (a first access point) to which the mobile terminal transmits the location registration request, into another service area provided by another access point (a second access point). In this case, because the router transfers the information on the Internet to the first access point on the basis of its routing table before being updated, the mobile terminal cannot receive that information.

SUMMARY OF THE INVENTION

The present invention is directed toward solving the above problem, and thus its object is to provide the method for providing information, the mobile communication system, and the communication apparatuses, wherein reliability of providing information to the mobile terminals is improved.

The above object is achieved by the method for providing information in a mobile communication system comprising a router connected to a predetermined network, and a plurality of

communication apparatuses which can communicate with mobile terminals and are connected to the router, in order to provide the information on the predetermined network to the mobile terminals, wherein: the router obtains the information from the predetermined network, and transfers this obtained information from the predetermined network to all of the communication apparatuses connected to the router; and each of the communication apparatuses receives the information from the predetermined network from the router, and transmits this received information on the predetermined network to a service area of its own provided by the communication apparatus.

In the method for providing information, the router transfers the information on the predetermined network to all of the communication apparatuses, and each of the communication apparatuses transmits that information to a service area of its own. A mobile terminal located in a service area provided by any of the communication apparatuses can receive that information, thereby the reliability of providing information to the mobile terminals is improved.

In the method for providing information, upon receiving a location registration request from the mobile terminal located in the service area of its own, each of the communication apparatuses registers information relating to the mobile terminal originating the request into its located terminal table of its own held and used for managing the mobile terminals located in the service area of its own provided by the communication apparatus; each of the communication apparatuses determines whether information relating to a destination mobile terminal of the received information from the predetermined network is included in the located

terminal table of its own; when the communication apparatus determines that the information relating to the destination mobile terminal is included in the located terminal table of its own, each of the communication apparatuses transmits the received information on the predetermined network to the destination mobile terminal; and when the communication apparatus determines that the information relating to the destination mobile terminal is not included in the located terminal table of its own, each of the communication apparatuses does not transmit the received information on the predetermined network to the destination mobile terminal.

In this method for providing information the reliability of providing the information to the mobile terminals is improved. Further, only when the communication apparatus determines that the destination of the information on the predetermined network to be transmitted is a mobile terminal located in a service area of its own, the communication apparatus transmits that information to that mobile terminal, thereby radio channels between the communication apparatus and the mobile terminals can be used efficiently.

From a similar point of view, in the method for providing information, each of the communication apparatuses sets up a delete time for the information relating to the mobile terminal registered in the located terminal table of its own; each of the communication apparatuses updates the delete time each time the location registration request is received from the same mobile terminal after the information relating to that mobile terminal is registered in the located terminal table of its own; and each of the communication apparatuses deletes the information relating to the

mobile terminal corresponding to the delete time from the located terminal table of its own when current time reaches the delete time.

Further from the similar point of view, in the method for providing information, when each of the communication apparatuses receives a request for deleting the information relating to the mobile terminal that has moved out from the service area of its own provided by the communication apparatus, each of the communication apparatuses deletes the information relating to the mobile terminal from the located terminal table of its own in response to the request.

The present invention includes the mobile communication system and the communication apparatus each suitable for the above methods for providing information.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings, in which:

Fig.1 shows an example of the configuration of the mobile communication system according to a first embodiment of the present invention;

Fig.2 shows an example of the configuration of a network connecting the access points to the router;

Fig.3 shows an example of the configuration of the mobile communication system according to a second embodiment of the present invention;

Fig.4 shows an example of the configuration of the mobile communication system

according to a third embodiment of the present invention;

Fig.5 shows an example of a located terminal table;

Fig.6 shows an example of the configuration of the mobile communication system according to a fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is described below with reference to the drawings. Fig.1 shows an example of the configuration of the mobile communication system according to the first embodiment of the present invention.

The mobile communication system shown in Fig.1 includes a router 110, access points (AP) 120-0 through 120-N which function as a plurality of communication apparatuses and are connected to the router 110, and a transmission network 130 connecting the router 110 and the access points 120-0 through 120-N. This mobile communication system provides the information on the Internet 200 via the router 110, the transmission network 130 and the access points 120-0 through 120-N to a mobile terminal (MT) 300 located in a service area provided by any one of the access points 120-0 through 120-N.

The router 110 connects the mobile communication system to the Internet 200. This router 110 obtains the information from the Internet 200 (hereinafter referred to as "information packets") either in response to a request from the mobile terminal 300 or autonomously. The router 110 transfers these obtained information packets via the transmission network 130 to all of the access points 120-0 through 120-N.

The transmission network 130 may have

various configurations. Fig.2 shows an example of the configuration of the transmission network 130 connecting the access points 120-0 through 120-N to the router 110.

Fig.2(a) shows a bus-type connection wherein a communication line 132 connected to the router 110 and communication lines 133-0 through 133-N connected to the access points 133-0 through 133-N respectively are connected to a bus 131. Also Fig.2(b) shows a star-type connection wherein the access points 120-0 through 120-N are connected by respective communication lines 134-0 through 134-N to the router 110. Further Fig.2(c) shows a line-type connection wherein the router 110 and the access point 120-0 are connected by a communication line 136 and the access points 120-0 through 120-N are connected by communication lines 136-0 through 136-N-1.

Each of the access points 120-0 through 120-N receives the information packets that are transferred from the router 110 via the transmission network 130, and transmits those packets to a service area of its own.

The mobile terminal 300 located in a service area provided by any one of the access points 120-0 through 120-N receives those information packets from the access point. For example, when the mobile terminal 300 is located in the service area provided by the access point 120-1, the mobile terminal 300 receives the information packets transmitted by the access point 120-1.

Thus, in the mobile communication system of this embodiment, the router 110 transfers the information packets obtained from the Internet 200 to all of the access points 120-0 through 120-N, and each of the access points 120-0 through 120-N transmits those information packets to a service

area of its own. Therefore, the mobile terminal 300 located in the service area provided by any one of the access points 120-0 through 120-N can receive the information packets, thereby the reliability of providing information to the mobile terminals is improved.

Fig.3 shows an example of the configuration of the mobile communication system according to the second embodiment of the present invention.

The mobile communication system shown in Fig.3 includes, as with the mobile communication system of the first embodiment shown in Fig.1, the router 110, the plurality of access points 120-0 through 120-N, and the transmission network 130 connecting the router 110 and the access points 120-0 through 120-N.

The router 110 obtains the information packets from the Internet 200, and transfers these information packets via the transmission network 130 to all of the access points 120-0 through 120-N.

Each of the access points 120-0 through 120-N receives a location registration request from each of the mobile terminals located in its own service area. This location registration request includes a terminal identification to identify the mobile terminal originating the request, such as a telephone number or an IP address allocated to the mobile terminal. Each of the access points 120-0 through 120-N registers the terminal identification included in the received location registration request into the located terminal table of its own held and used for managing mobile terminals located in a service area of its own.

Also, each of the access points 120-0 through 120-N receives the information packets from the router 110 via the transmission network 130.

Each of these information packets include the terminal identification that represents the destination mobile terminal of that information packet. When each of the access points 120-0 through 120-N receives the information packets, it determines whether the terminal identification in those received information packets is included in the located terminal table of its own.

In the case that the terminal identification in the received information packets is included in the located terminal table of its own, each of the access points 120-0 through 120-N considers that the destination mobile terminal of those information packets is located in a service area of its own, and transmits those information packets to that service area. While, in the case that the terminal identification in the received information packets is not included in the located terminal table of its own, each of the access points 120-0 through 120-N considers that the destination mobile terminal of those information packets is not located in its own service area, and discards the received information packets without transmitting.

It is considered as an example that the information packets are transmitted to the mobile terminal 300 located in the service area provided by the access point 120-1. In this case, the access point 120-1 registers the terminal identification included in the location registration request from the mobile terminal 300 into the located terminal table of its own. Then, upon receiving the information packets, the access point 120-1 determines whether the terminal identification in the received information packets (that is the terminal identification of the mobile terminal 300) is included in its located terminal table. It is here assumed that the access point 120-1 determines

that the terminal identification of the mobile terminal 300 is included in the located terminal table. The access point 120-1 then transmits those information packets to the mobile terminal 300. The mobile terminal 300 located in the service area provided by the access point 120-1 receives those information packets from the access point 120-1.

On the other hand, each of the other access points 120-0 and 120-2 through 120-N determines whether the terminal identification in the received information packets (that is the terminal identification of the mobile terminal 300) is included in its own located terminal table. Since the access points 120-0 and 120-2 through 120-N determine that the terminal identification of the mobile terminal 300 is not included in their respective located terminal tables, those access points discard the received information packets without transmitting.

Thus, in the mobile communication system of this embodiment, the router 110 transfers the obtained information from the Internet 200 to all of the access points 120-0 through 120-N, and each of the access points 120-0 through 120-N transmits this information from the Internet 200 to the destination mobile terminal in the case that the terminal identification of the destination mobile terminal in the received information from the Internet 200 is included in the located terminal table of its own, i.e. the destination mobile terminal of that information from the Internet 200 is located in a service area of its own. Therefore, as with the first embodiment, the mobile terminal 300 located in the service area provided by any one of the access points 120-0 through 120-N can receive the information packets, thereby the reliability of providing information to the mobile terminals is

improved. Also, since each of the access points 120-0 through 120-N transmits the information on the Internet 200 to the destination mobile terminal only when the terminal identification of the destination mobile terminal in the received information on the Internet 200 is included in the located terminal table of its own, the radio channels between the access points and the mobile terminals can be used efficiently.

Fig.4 shows an example of the configuration of the mobile communication system according to the third embodiment of the present invention.

The mobile communication system shown in Fig.4 includes, as with the mobile communication system according to the first embodiment shown in Fig.1, the router 110, the plurality of access points 120-0 through 120-N, and the transmission network 130 connecting the router 110 and the access points 120-0 through 120-N.

The router 110 obtains the information packets from the Internet 200, and transfers those information packets via the transmission network 130 to all of the access points 120-0 through 120-N.

Each of the access points 120-0 through 120-N receives the location registration requests from the mobile terminals located in its own service area. Each of these location registration requests includes the terminal identification to identify the mobile terminal originating the request.

Each of the access points 120-0 through 120-N registers the terminal identification included in the received location registration request into the located terminal table of its own held and used for managing the mobile terminals located in the service area of its own, and sets up a time to delete this registered terminal identification.

Fig.5 shows an example of the located terminal table according to the third embodiment of the present invention. As shown in Fig.5, the located terminal table associates the terminal identifications of the mobile terminals located in the service area provided by the access point (located terminals) with the times to delete the corresponding terminal identifications (information delete times). The information delete time may be, for example, a time determined by adding five minuets to the time that the access point receives the location registration request from the corresponding mobile terminal.

When each of the access points 120-0 through 120-N registers the terminal identification into the located terminal table, and also sets up the delete time for the terminal identification, if thereafter the access point again receives the location registration request from the same mobile terminal of which terminal identification is already registered, then the access point updates the information delete time for that mobile terminal in its located terminal table. For example, each of the access points 120-0 through 120-N may update the information delete time into a time determined by adding five minuets to the time that the access point receives the location registration request again.

Also, each of the access points 120-0 through 120-N monitors those information delete times in the located terminal table of its own. If current time reaches the information delete time, the access point deletes the terminal identification corresponding to that information delete time.

It is considered as an example that the mobile terminal 300 moves from the service area provided by the access point 120-0 to the service

area provided by the access point 120-1.

In this case, when the access point 120-0 receives the location registration request from the mobile terminal 300 located in the service area of its own provided by the access point, then the access point registers the terminal identification of the mobile terminal 300 into the located terminal table of its own and sets up the delete time for that terminal identification. Then, the access point 120-0 updates this information delete time in its located terminal table each time the access point receives the location registration request from the same mobile terminal 300. After the mobile terminal 300 subsequently moves out from the service area provided by the access point 120-0, the mobile terminal 300 no longer transmits the location registration request to the access point 120-0. Therefore, the access point 120-0 no longer updates the information delete time for the terminal identification of the mobile terminal 300 in the located terminal table of its own. The access point 120-0 thereafter deletes the terminal identification of the mobile terminal 300 in the located terminal table of its own when current time reaches the information delete time for that terminal identification.

Each of the access points 120-0 through 120-N in this embodiment operates in a similar manner to the one in the second embodiment when the access point receives the information packets from the router 110 via the transmission network 130.

That is, each of the access points 120-0 through 120-N determines whether the terminal identification in the received information packets is included in the located terminal table of its own, when the access point receives the information packets.

In the case that the terminal identification in the received information packets is included in the located terminal table of its own, each of the access points 120-0 through 120-N transmits those information packets to the service area of its own. While, in the case that the terminal identification in the received information packets is not included in the located terminal table of its own, each of the access points 120-0 through 120-N discards the information packets without transmitting.

Fig.6 shows an example of the configuration of the mobile communication system according to the fourth embodiment of the present invention.

The mobile communication system shown in Fig.6 includes, as with the mobile communication system according to the first embodiment shown in Fig.1, the router 110, the plurality of access points 120-0 through 120-N, and the transmission network 130 connecting the router 110 and the access points 120-0 through 120-N.

The router 110 obtains the information packets from the Internet 200, and transfers those information packets via the transmission network 130 to all of the access points 120-0 through 120-N.

Each of the access points 120-0 through 120-N receives the location registration requests from the mobile terminals located in the service area of its own. Each of these location registration requests includes the terminal identification to identify the mobile terminal originating the request.

Upon receiving the location registration request, each of the access points 120-0 through 120-N registers the terminal identification in the received location registration request into the

located terminal table of its own held and used for managing the mobile terminals located in the service area of its own.

Also, each of the access points 120-0 through 120-N receives information delete requests from the mobile terminals located in the service area of its own. When a mobile terminal moves out from a service area provided by a predetermined access point, the mobile terminal transmits a request (hereinafter referred to as information delete request) to delete the terminal identification of this mobile terminal from the located terminal table held by the predetermined access point. This information delete request includes the terminal identification of the mobile terminal originating the request, and identification information of the access point having the located terminal table including the terminal identification being requested to delete.

Upon receiving the information delete request, each of the access points 120-0 through 120-N analyzes the identification information of the access point included in the received information delete request, and then transfers this information delete request to the corresponding access point indicated by that identification information.

Upon receiving the information delete request, this corresponding access point analyzes the terminal identification included in the received information delete request, and then deletes the indicated terminal identification from the located terminal table of its own.

It is considered as an example that the mobile terminal 300 moves from the service area provided by the access point 120-0 into the service area provided by the access point 120-1.

In this case, the mobile terminal 300

transmits to the present access point 120-1 providing the service area in which the mobile terminal 300 is located after the movement the information delete request to delete its terminal identification from the located terminal table of the previous access point 120-0 providing the service area in which the mobile terminal 300 was located before the movement. Upon receiving the information delete request, the access point 120-1 analyzes the identification information of the access point included in the received information delete request, and then transfers this information delete request to the corresponding access point (that is the access point 120-0 in this case) indicated by that identification information.

Upon receiving this information delete request, the access point 120-0 analyzes the terminal identification included in the received information delete request, and then deletes the indicated terminal identification (that is the terminal identification of the mobile terminal 300 in this case) from the located terminal table of its own.

Each of the access points 120-0 through 120-N in this embodiment operates in a similar manner to the one in the second embodiment when the access point receives the information packets from the router 110 via the transmission network 130.

That is, each of the access points 120-0 through 120-N determines whether the terminal identification in the received information packets is included in the located terminal table of its own, when the access point receives the information packets.

In the case that the terminal identification in the received information packets is included in the located terminal table of its own,

each of the access points 120-0 through 120-N transmits those information packets to the service area of its own. While, in the case that the terminal identification in the received information packets is not included in the located terminal table of its own, each of the access points 120-0 through 120-N discards those received information packets without transmitting.

As described above, in the present invention, the router transfers the information on the predetermined network to all of the communication apparatuses, and each of the communication apparatuses transmits this information on the predetermined network to the service area of its own provided by the communication apparatus. Therefore, the mobile terminal located in the service area provided by any of the communication apparatuses can receive the information from the predetermined network, thereby the reliability of providing information to the mobile terminals is improved.

The present invention is not limited to the specifically disclosed embodiments, and variations and modifications may be made without departing from the scope of the invention.